

Electric vehicles and electric drives of essentially new type

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I. INTRODUCTION

The principal type of energy for mankind, i.e. for heat and light production infrastructure, for supplying maintenance of transport and industry work, is the electric power. About 90% of the electric power is produced by EG (EG – the electric generator), about 60% of which are used from EM (EM – the electric motor). EM (EM – electrical machines, i.e. EM and EG, currently has two directions of development – as SA-EMn (SA-EMn separate object of general purpose industrial use, in abbreviated form – SA-EMn) and inside of electric drive OM-EM (OM-EM - electric drive). At the same time depending on convenience of description, the electric drive can include the operating member of cars or not. Nowadays SA-EM and OM-EM, have substantial drawbacks and limitations. SA-EM – bulky; material-intensive; having small efficiency, especially widely used medium and low powered EM. OM-EM – have low energy efficiency. For example, the existing electric vehicles have to carry approximately 500 kg of accumulators. For cooling of accumulators and electric motors it is used powerful cooling systems, i.e. much of energy is lost inefficiently.

Also, it is worth to note that presently quantitative ratio of electric vehicles to cars with internal combustion engines is very small, which is about 0,1%. At the same time 80% of air pollution in megalopolises appears because of emissions of motor transport, using internal combustion engines. Aircrafts with electric motors exist only in general purpose aviation that is on experimental level. At the present time the structure of energy complex as following: 2/3 of electric power produced on thermal power plants, where gas or coal serves as the main fuel [1]. And the remaining third part — on nuclear power plants and hydroelectric power station that can be considered conditionally environmentally friendly. Such type of stabilization of balance of electric power sources refer to the technological capabilities, safety precautions of mankind from nuclear reactions of nuclear power plants, water resources, resources of natural gas and financial expenses. In the near future, we shouldn't wait for dramatic shift of such situation. This factor delineates that mass transition of vehicles from the internal combustion engines (ICE) on SA-EMn will lead to the need of increased production of electric power. It will result to additional emission of harmful substances in the environment, though these emissions can be made in the power plants located out of megalopolises.

We have developed several works, assigned for solution a number of interconnected tasks (taking into account the above-stated factors), assuming the creation of revolutionary way of innovative energy - saving technologies ("blasting innovation") [2], the absolutely new type of power saving OM-EMn that promotes:

- wide use of the electric power in all spheres of machinery manufacturing, including the household equipment, industrial one and vehicles;
- decrease of harmful substances emission by mechanisms, machines, including vehicles, power plants as well, due to economical use of electric energy;
- decrease in prime cost and conditions of mechanism, car maintenances, including vehicles.

At the same time the projects facilitate the creation of new types of cars and mechanisms with advanced functional features.

The solution of the above-stated tasks will be an essential step in the direction to one of the main strategic objectives of mankind:

- assistance to the general technological development,
- environmental friendly attitude to nature, consequently, creation of healthy condition for life, including mankind, faunae and flora.

II. ESSENCE OF SCIENTIFIC AND TECHNICAL WORKS

It is generated technical solutions for financing the implementation and testing:

- (1) by helicopter: the leading screw of the helicopter which doesn't have an analog with the self-compensated torque;
- (2) on the aircraft: The Z-CTV-subsystem with the electric drive executed with a possibility of vertical and horizontal draft (has no analog),
- (3) on the electric vehicle: energy efficient low-power OM-EMn with "wide range lever".

Offered OM-mEM have from two to seven times higher energy efficiency than their alternatives available on the world market and will provide replacement of vehicles with internal combustion engines (ICE) by OM-EMn. It will create new direction of mechanical engineering. These advantages will lead to the fact that OM-mEM will expel out of the traditional market the famous generation of electric drives with oEM and also to broad application of OM-EM in new areas, for example in aviation (OM-EM belongs to "blasting innovation") [2], which drastically change the ratio of values in the market and, eventually, destroy (expel) the products or services prevailed earlier). All technology solutions are protected [5, 6, 8]. Nowadays proof of principle prototype of essentially new type of the electric engine has been created, which confirmed initial theoretical calculations and prospects of the chosen new scientific and technical direction. [9, 10].

III. MARKET OF ANNUAL CONSUMPTION

Market of electric vehicles. According to predictions the world market of electric vehicles will reach 121 bln. US dollars in 2020 /http://www.strategyr.com/MarketResearch/Electric_Motors_Market_Trends.asp/. Capacity of the world market of vehicles is 1,6 trillion dollars /https://hightech.fm/2017/07/03/china_batteries/. Market of ASI (ASI – the Aerospace industry). Today the revenue of world ASI, just in the USA, takes about 180 bln. dollars. It is about 0,6% of world GDP. Annual money turnover of other sectors of economy which are directly connected with use of space technologies exceeds a turn of actually space industry approximately by 10 times.

IV. NOVELTY OF TECHNOLOGY

During more than 180 years of SA-EMn development history, OM-EM and their work principles was guided by concepts of one-vector inductive coupling and they might be named oEM (oEM – one-vector electric Machine) [3, 4]. This days the concept of one-vector inductive coupling in technical realization (the supporting technology) has reached the limit of opportunities. The works offered by us are based by, at least, one of the five concepts, each of which is fundamentally new: - SA-EM multi vector and/or multisector inductive coupling; - energy efficient section or with the compensated torque in electric drives; SA-EM or OM-EM created, at least, on the basis of one of these concepts will be marked as jump transition in progress of mechanical engineering.

New concepts define new directions of development SA-EM and OM-EM. SA-mEM (SA-mEM – SA-EM created on the basis of the concept of multi-vector inductive coupling), due to increased surface area of inductive coupling for the unit of electric motor volume, in comparison with the known SA-omens (SA-omens– SA-EM created on the basis of the concept of a one vector inductive coupling) has following advantages [5, 6]:

- output power is higher from two to four times;
- material consumption is lower up to two times, in addition when performing multisectoral – it is even lower;
- higher efficiency, especially for low and medium power, due to reduction of a share of inefficient part of the

winding, absorbing considerable share of the electric power (on useless and harmful Om resistance).

The above-stated advantages are proved:

- according to the mathematical analysis and computer modeling and calculation in international conference report [7];

- according to the experimental test of the created proof of principle prototype of mEM and NATD commission (NATD – the National agency of technological development)- Extract from the Protocol of an internal board meeting of "NATR" issued on September 04, 2017 No. 43/17) which approved initial theoretical calculations and prospects of the selected new scientific and technical direction / 7, 8/. Secondly, the concept of Z-CTV and various designs of Z-CTV-subsystems for its realization, are based on energy efficient use of the multidirectional jet force or the difference of pressure created by engine. At the same time the concept successfully could be realized for the object movements in any environment: vacuum, gas, liquid. The energy efficiency of the Z-CTV concept is that created by engine, at least, two of four side vectors multidirectional jet force or the difference of pressure, which usually compensate each other, additionally move in one direction by means of surfaces of special design. For example, the concept allows by simple designs of Z-CTV-subsystems simultaneously create forces of the horizontal and strong unidirectional vertical draft. At the same time the energy efficiency of the engine in the horizontal direction also increases.

New concepts define new directions of development of mechanical engineering including SA-EMn and OM-EMn. All technology solutions are protected.

1. Электронный учебник "Электрические машины" . http://elmech.mpei.ac.ru/em/em/em_cont_0.htm – Л. Наука, 1968, 487 с.
2. Усольцев А.А. Электрические машины/Учебное пособие. СПб: НИУИТМО, 2013, 416 с.
3. WO 2015137790 A3, 12.11.2015, Sapargaliyev A.A.;
4. WO 2016153328 A3, 15.12.2016, Sapargaliyev A.A
5. "Volume Density of Power of Multivector Electric Machine", World Academy of Science, Engineering and Technology International Journal of Electrical, Computer, Energetic, Electronic and Communication Engineering Vol:11, No:6, 2017 (<https://waset.org/Publication/volume-density-of-power-of-multivector-electric-machine/10007686>)
6. WO 2016195465 A1, 8.12.2016, Sapargaliyev A.A.
The conclusions of experimental test of proof of principle prototype of mEM + the Appendix 4 – the video, showing the work of principle mEM prototype.
7. "An extract from the Protocol of an internal board meeting of JSC NATR" issued on September 04, 2017 No. 43/17mEM.

Приложений:

Приложение 1 – текстстатии "Volume Density of Power of Multivector Electric Machine";

Приложение 2 – копия Заключения экспериментального испытания созданного опытно-лабораторного образца mEM;

Приложение 3 – копия «Выписка из Протокола очного заседания Правления АО «НАТР» от 04 сентября 2017г. № 43/17mEM;

Приложение 4 – видео-материал показывающий вид и работу опытно лабораторного образцамEM.

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Best regards, Professor Aldan Sapargaliyev